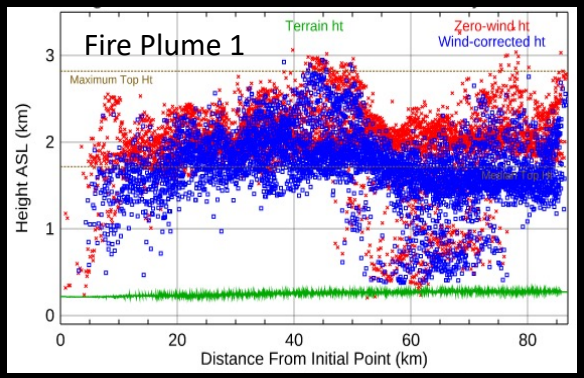
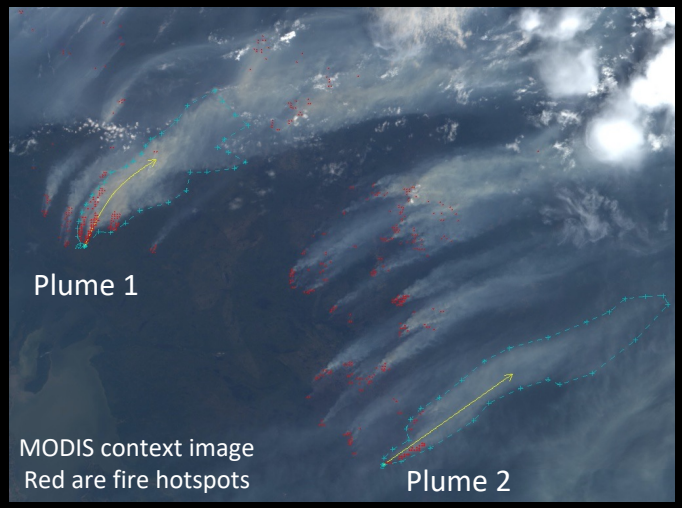
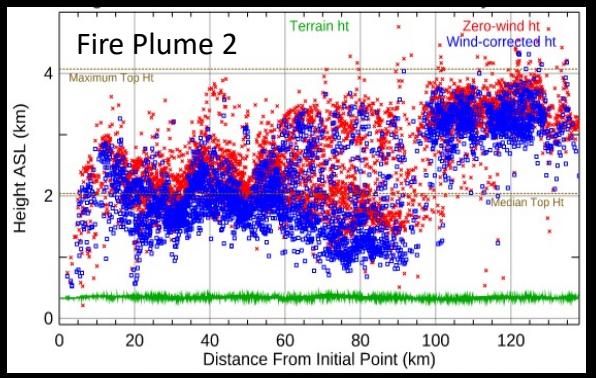
Numerous Wildfire Smoke Plumes in Northwest Ontario, Canada

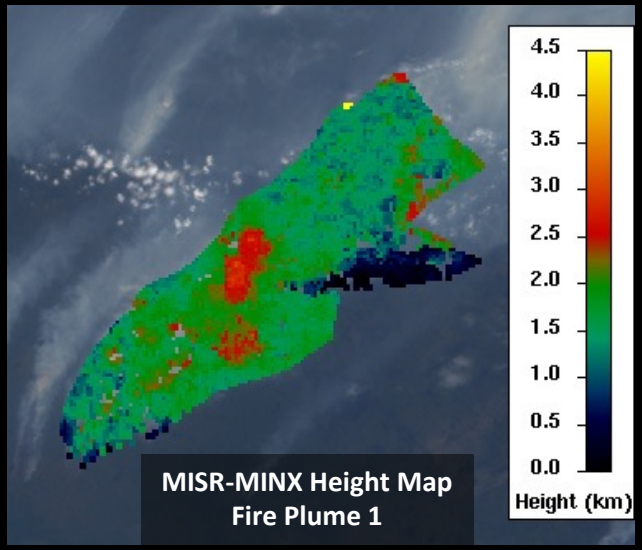
MISR Active Aerosol Plume-Height (AAP) Project 17 July 2021





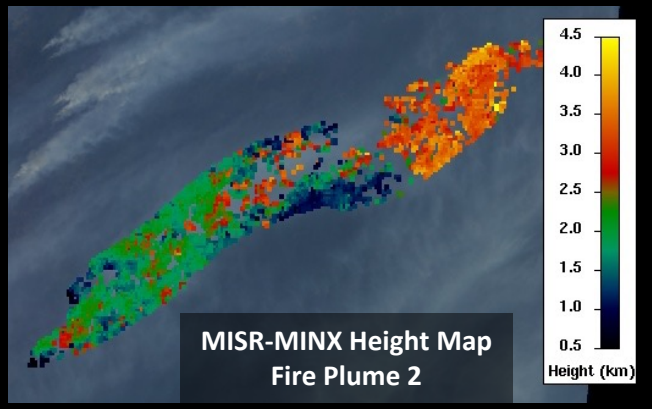


Red = zero-wind height
Blue = wind-corrected height
Green = surface elevation



The ***height*** at which smoke is lofted into the atmosphere affects ***how long*** it will stay aloft, ***how far*** it will travel, and ***how much of an impact*** it will have on air quality downwind, and regional climate.

Parallax, the change in apparent plume position relative to the surface, as observed by NASA's Multi-angle Imaging Spectroradiometer (***MISR***) instrument, makes it possible to map the height of ***smoke***, ***dust***, and ***volcanic plumes*** near-source, where plume features are visible in the multi-angle views.

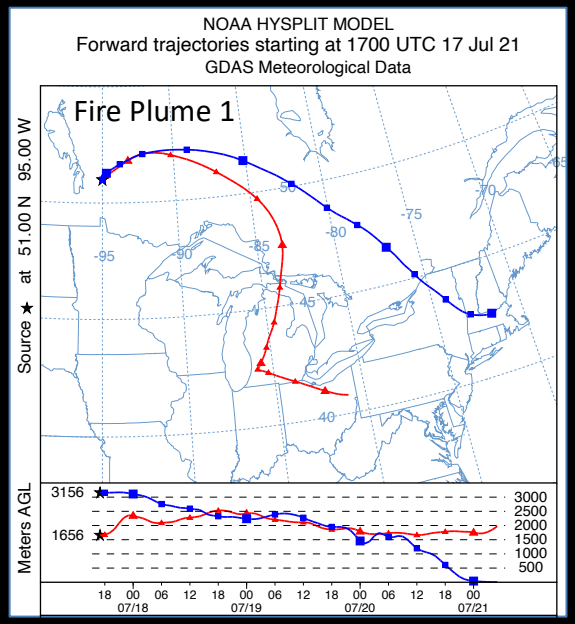


R. Kahn , K. Junghenn Noyes/ NASA GSFC

Smoke from most of the fires in NW Ontario on this day was injected to about 2 km ASL, probably within the near-surface boundary layer, such as Plume 1 (left). However, some fires injected smoke up to ~3.5 km, such as Plume 2 (right), ***making long-distance transport more likely***.

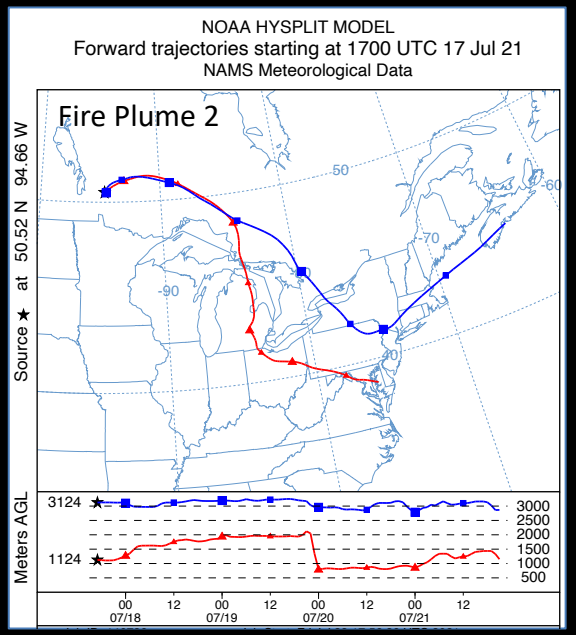
Wildfire Smoke Transport: Northwest Ontario to US East Coast

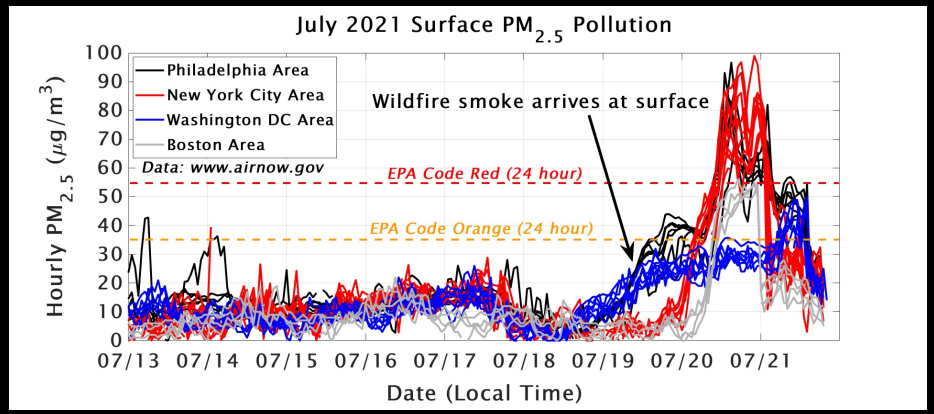
MISR Active Aerosol Plume-Height (AAP) Project 17-20 July 2021



Poor air quality was recorded along the US East Coast on 20-21 July, from Massachusetts to Washington DC. ***Forward and backward trajectory simulations*** from the NOAA HySPLIT model* show that smoke from the NW Ontario fires is the likely cause. Based on the simulations, smoke from the vicinity of Fire Plume 1, injected ~3 km above the surface on 17 July, reached Massachusetts ~3.5 days later, and smoke injected at ~1.5 km near Plume 2 would have affected the Washington DC region.

Although these simulations are approximate, and the results vary in detail depending on how the model is initialized, they demonstrate that ***combining satellite and surface-based measurements with modeling*** helps complete the picture of these events. The results also highlight the impact ***injection height*** has on the subsequent dispersion of the smoke.





Measurements of near-surface ***airborne particles smaller than 2.5 microns*** in diameter were made in 0.5˚ lat.-lon. regions around Boston, New York City, Philadelphia, and Washington DC.

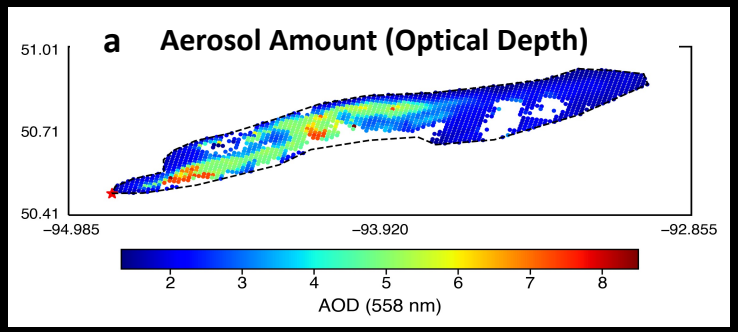
*NOAA Air Resources Lab., Stein et al., Bull. Amer. Meteor. Soc. 2015.

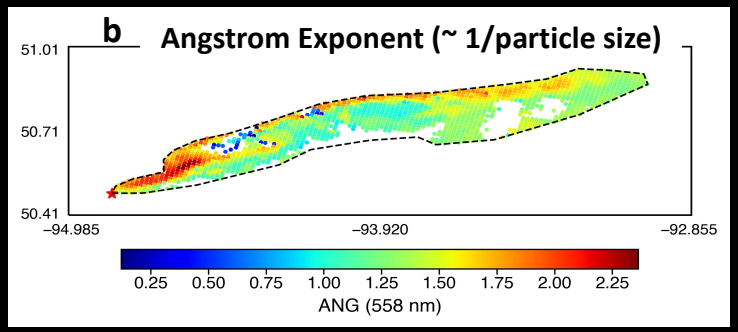
R. Kahn , K Junghenn-Noyes, R. Stauffer/ NASA GSFC

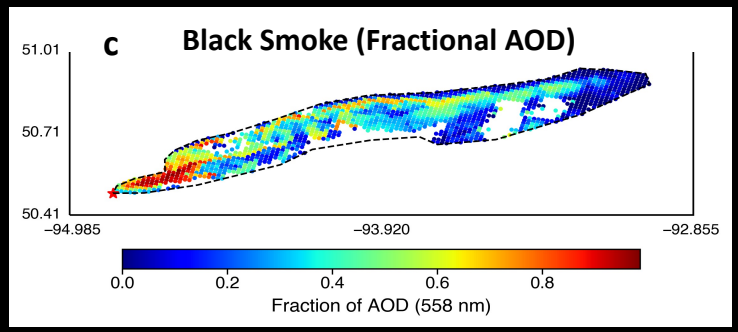
Wildfire Smoke Plumes in Northwest Ontario, Canada

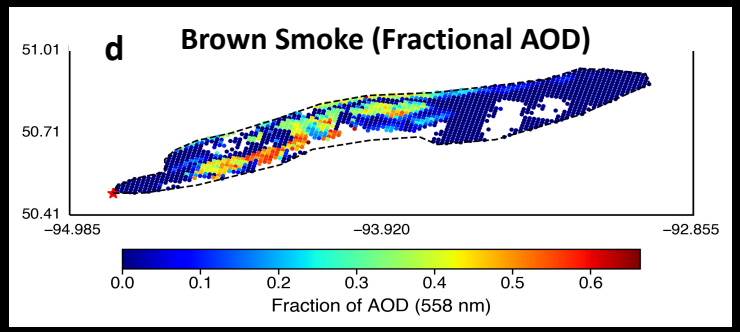
MISR Active Aerosol Plume-Height (AAP) Project 17 July 2021

MISR Research Algorithm – Aerosol Amount and Type Retrievals









The MISR Research Aerosol (RA) retrieval algorithm derives (a) aerosol ***amount***, along with constraints on (b) ***particle size***, as well as particle ***shape*** and ***light-absorption***. These retrieved properties are interpreted here as the fractional amounts of (c) ***black smoke*** and (d) ***brown smoke*** in Plume 2. The aerosol amount in this plume is substantial, in places near the limit of what can be retrieved from the remote-sensing observations. Small, spherical, strongly light-absorbing black smoke is concentrated near the source, which is typical of intense fires. Larger brown smoke tends to dominate downwind, as organic volatiles and water vapor generated by the fire condense on existing particles or form new particles in the cooling plume.

***R. Kahn, V. Flower, J. Limbacher* / NASA GSFC**